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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/715,282	11/16/2000	Anne E. Miller	042390.P8276	6590

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EXAMINER

CHEN, KIN CHAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/715,282	Applicant(s) MILLER ET AL.	
	Examiner Kin-Chan Chen	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 16 July 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 12-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election of group I, claims 1-11, in Paper No. 7 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (US 6,077,337) in view of Watts et al (US 5,897,375; hereinafter "Watts").

Lee teaches a method of forming copper interconnect. A copper diffusion barrier layer (such as tantalum, the limitation of instant claim 7) may be formed in at least a damascene structure. A copper layer may be formed over the barrier layer. A portion of the copper layer may be removed by chemical mechanical polishing (col. 6, lines 40-42; 44-48; col. 7, lines 1-24). A slurry comprising a chelating organic acid buffer system and

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colloidal silica may be used for CMP (col. 5, lines 4-13). In reference to claim 6, Lee teaches, in addition to the above process steps, removing at least a portion of the barrier layer by CMP with the slurry comprising chelating organic acid buffer system and colloidal silica. Lee is silent about using oxidizer for polishing barrier layer, therefore, it would have been obvious to one with ordinary skill in the art to polishing barrier layer without oxidizer because it is an additional step without any benefit.

Unlike the claimed invention, Lee does not disclose using oxidizer in the slurry for chemical mechanical polishing of the copper layer. In the chemical mechanical polishing for the copper layer, Watts (col. 1, lines 15-18; col. 2, lines 30-33) teaches using the slurry comprising chelating organic acid buffer system (e.g., citric acid and citrate), silica abrasive, and oxidizer (e.g., hydrogen peroxide). Watts teaches using oxidizer in the slurry to oxidize the top portion of the copper and through the progressive oxidation and removal of layer will enable effective copper CMP. Hence, it would have been obvious to one with ordinary skill in the art to modify copper CMP of Lee by using oxidizer in the slurry as taught by Watts because Watts teaches that to do so will oxidize the top portion of the copper and enable effective copper CMP. As to claim 6, Lee does not disclose that a copper seed layer may be formed on the barrier layer, and copper layer may be formed thereon. Watts teaches the said limitation (col. 4, line 17). Because applying said seed layer is a common practice for improving the deposition of the copper on the barrier layer and avoiding the separation, and because Watts teaches the limitation, hence, it would have been obvious to one with ordinary skill in the art to add this conventional process step as taught by Watts in order to improve the deposition of

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the copper and avoid the separation. The limitations of dependent claims 2 and 9 have been addressed above.

As to dependent claims 3 and 8, Lee teaches citric acid and potassium citrate (col. 5, lines 9-13).

As to dependent claims 4, 5, 10, 11, Watts teaches that the slurry may comprise corrosion inhibitor such as benzotriazole (col. 2, lines 34-35; col. 4, lines 66-67). Because it is a common corrosion inhibitor used in the CMP slurry and because it is disclosed by Watts, hence, it would have been obvious to one with ordinary skill in the art to use same in the process of Lee in order to provide their art recognized advantages and produce an expected result.

In reference to dependent claim 11, Lee (col. 4, lines 52-53) teaches the slurry has a pH in the range of 2 to 4, which is within the range cited.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.

August 8, 2002

K. C. Chen
Patent Examiner
Group Art Unit 1765